

PATENT ABSTRACTS OF JAPAN

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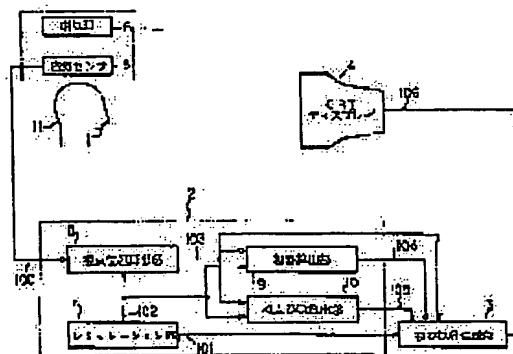
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KACHI KOJI

(54) PSEUDO VISIBILITY DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain a sense similar to real experience for a user when it is applied to a simulator, etc., by calculating respective information related to a position of a viewpoint, a visual field and posture in a virtual space based on the position of the head in a rear space, using these information and generating a pseudo visibility image observed from the viewpoint of the user in the virtual space.

SOLUTION: An on-head sensor 1 detects magnetism generated from a magnetic source 6 by a magnetic sensor 5 to output the head position data 100 of the head of the user 11. A visibility display information calculation part 2 is provided with a simulation part 7, a viewpoint position calculation part 8, visual field calculation part 9 and a viewpoint posture calculation part 10, and the simulation part 7 outputs the pseudo calculation result data 101 to a pseudo visibility generation part 3. Further, the part 7 calculates a three-dimensional position of an image display part of a CRT display 4 in the virtual space based on the pseudo calculation result to output the virtual position data 102 to the viewpoint position calculation part 8, the visual field calculation part 9 and the viewpoint posture calculation part 10 respectively.



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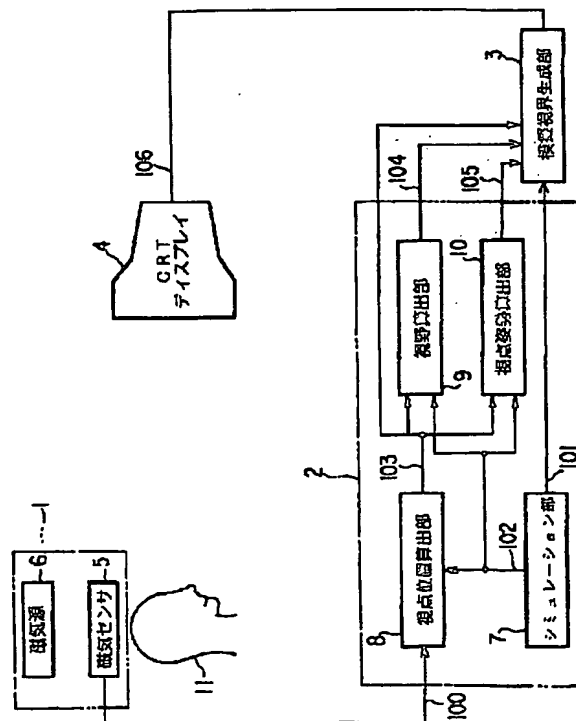
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【特許請求の範囲】

【請求項1】 予め設定されている仮想空間において使用者の操作に応じた模擬視界画像を生成する模擬視界装置において、

実空間における使用者の頭部の位置および姿勢を検出する頭部位置検出手段と、

前記頭部位置検出手段によって検出された実空間における使用者の頭部の位置および姿勢に基づいて、仮想空間における使用者の視点の位置、視野、および姿勢に関する各情報を算出する視界表示情報算出手段と、

前記視界表示情報算出手段によって算出された仮想空間における視点の位置、視野、および姿勢に関する各情報を使用して、仮想空間における使用者の視点から観測される模擬視界画像を生成する模擬視界生成手段と、
前記模擬視界画像生成手段によって生成された模擬視界画像を表示する模擬視界表示手段とを有することを特徴とする模擬視界装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】 本発明は、例えば各種のシミュレータもしくは娯楽用の遊具に適用する模擬視界装置に関する。

【0002】

【従来の技術】 近年、例えば自動車や航空機の運転シミュレータやビデオゲーム装置に適用する模擬視界装置が開発されている。このような模擬視界装置には、使用者の操作に応じてあたかも実際の経験と同等の感覚を得ることのできる機能が求められる。このための方法の一つとして、計算機によって目的とする仮想空間を作成し、使用者の操作に応じて変化する模擬計算処理の結果を模擬視界画像に変換して表すことが行われている。

【0003】 このような模擬視界装置では、例えば以下のように模擬視界画像が生成される。すなわち、実空間における使用者の視点および表示画面の三次元的な位置関係に基づいて、仮想空間における使用者の視点および表示画面の三次元的な位置が予め設定される。この設定された位置に基づいて、例えば仮想空間において使用者の視点から表示画面を見た場合の視点の位置、仮想空間において視点から表示画面を見た場合の視野の広さ、および仮想空間において視点から表示画面を見た場合の視点の姿勢に関する各情報が算出される。これらの視点の位置、視野の広さ、および視点の姿勢に関する各情報に基づいて、仮想空間における使用者の視点から観測される模擬視界画像が生成される。

【0004】 この結果、従来の模擬視界装置を例えば自動車の運転のシミュレータに適用すると、仮想空間の自動車の模擬的進行と共に仮想空間における視点および表示画面が進行する。従って、表示画面に写しだされる模擬視界画像が更新され、使用者はあたかも実際に自動車に乗って進行しているかのように感じるようになる。

【0005】 ところで、従来の模擬視界装置においては、仮想空間における使用者の視点の位置、視野の広さ、および視点の姿勢に関する各情報の値はそれぞれ一定値として設定される。つまり、従来の模擬視界装置においては、仮想空間の視点と表示画面との三次元的な位置関係は常に一定であった。

【0006】 ところで、一般に使用者は頭を動かしたり首を振ったりするために、実空間においては使用者の視点と表示装置との三次元的な位置関係が変動することがある。ここで、仮想空間において使用者の視点から表示画面を見るということを、例えば実空間において人が窓から景色を見ることと同等であると仮定してみる。人が窓から景色を見ているときに視点の位置を変化させると、窓から見える景色はそれに応じて変化し、窓から近い位置の景色ほど変化は大きくなる。すなわち、仮想空間において視点の位置が変化すると、表示画面の模擬視界画像はそれに応じて変化し、その変化は仮想空間において表示画面に近いところほど大きくなると考えられる。

【0007】 しかし、上述したように従来の模擬視界装置においては、仮想空間の視点と表示画面との三次元的な位置関係は常に一定であり、実空間の視点の位置が変化しても表示画面の模擬視界画像が変化することはなく、使用者に実際の経験とは異なる感覚を与えてしまっていた。

【0008】

【発明が解決しようとする課題】 上述したように従来の模擬視界装置においては、仮想空間における使用者の視点と表示画面との三次元的な位置関係は常に一定であるため、実空間において使用者の視点移動しても仮想空間の模擬視界画像は変化しないという問題点があった。本発明は、実空間の使用者の視点の移動と連動して仮想空間における模擬視界画像が変化する模擬視界装置を提供することを目的とする。

【0009】

【課題を解決するための手段】 上記課題を解決するため本発明は、実空間の視点の変化に連動して仮想空間の視点を変化させて、模擬視界画像を生成することを骨子としている。すなわち本発明は、予め設定されている仮想空間において使用者の操作に応じた模擬視界画像を生成する模擬視界装置において、実空間における使用者の頭部の位置および姿勢を検出する頭部位置検出手段と、頭部位置検出手段によって検出された実空間における使用者の頭部の位置および姿勢に基づいて、仮想空間における使用者の視点の位置、視野、および姿勢に関する各情報を算出する視界表示情報算出手段と、視界表示情報算出手段によって算出された仮想空間における視点の位置、視野、および姿勢に関する各情報を使用して、仮想空間における使用者の視点から観測される模擬視界画像を生成する模擬視界生成手段と、模擬視界画像生成手段

によって生成された模擬視界画像を表示する模擬視界表示手段とを有する。

【0010】このような構成の模擬視界装置においては、実空間における頭部の位置および姿勢に基づいて仮想空間における視点の位置、視野、および姿勢に関する各情報が算出される。そして、算出された各情報を使用して、仮想空間における使用者の視点から観測される模擬視界画像が生成される。

【0011】そのため、実空間において使用者が例えば頭を動かすなどして視点が移動した場合でも、その実空間の視点の変化に応じて仮想空間の視点に変化する。そして、変化した仮想空間の視点と表示画面との三次元的な位置関係に基づいて、模擬視界画像が生成される。つまり、実空間の使用者の視点の移動にともなって模擬視界画像も変化するの、使用者はより現実に近い感覚を得ることが可能となる。

【0012】ここで、仮想空間における視点の位置とは、例えば仮想空間における視点の三次元的な座標である。また、仮想空間における視点の視野とは、例えば仮想空間に模擬視界表示手段の位置を仮定した場合に、視点から模擬視界表示手段を見た場合に観測される仮想空間の広さである。さらに、仮想空間における視点の姿勢とは、仮想空間の視点から模擬視界表示手段を見た場合の姿勢、すなわち使用者の視線方向と左右の傾きである。

【0013】

【発明の実施の形態】

（装置の構成）図1は、本発明の実施形態に係る模擬視界装置の構成を示すブロック図である。この模擬視界装置は大別して、頭部センサ1、視点表示情報算出部2、模擬視界生成部3、およびCRTディスプレイ4を有している。

【0014】頭部センサ1は、磁気センサ5および磁気源6を有し、磁気センサ5によって磁気源6から発生する磁気を検知し、使用者11の頭部の三次元的な位置である頭部位置データ100を出力するものである。

【0015】磁気センサ5は、例えばホール素子、磁気抵抗素子などから構成されており、磁気源6から発生する磁気を十分検知できる範囲で、磁気源6に対して三次元的な相対位置を変化させることができる場所に設置するものである。具体的には、磁気センサ5は使用者11の被るヘルメット等に設置される。

【0016】磁気源6は、CRTディスプレイ4に対する三次元的な相対位置が一定であるように構成される。具体的には、磁気源6は使用者11が座る座席に設置され、この座席とCRTディスプレイ4とが結合して構成される。

【0017】本実施形態の視界表示情報算出部2は、シミュレーション部7、視点位置算出部8、視野算出部9、および視点姿勢算出部10を有しており、通常では

汎用計算機により構成されるものである。

【0018】シミュレーション部7は、目的とする仮想空間が予め設定されていて、この仮想空間において使用者の操作に応じた模擬計算処理を実行し、さらに模擬計算の処理結果に基づいて仮想空間における表示画面の位置を算出するものである。

【0019】具体的には、シミュレーション部7は、仮想空間において使用者の操作に応じた所定の模擬計算処理を実行し、この処理結果である模擬計算結果データ101を模擬視界生成部3に出力する。次に、シミュレーション部7は、模擬計算の結果に基づいて、仮想空間におけるCRTディスプレイ4の画像表示部の三次元的な位置を算出し、この処理結果である仮想位置データ102を視点位置算出部7、視野算出部7、および視点姿勢算出部10のそれぞれに出力する。

【0020】ここで、例えば本実施形態を自動車の運転シミュレータに適用する場合、シミュレーション部7は自動車の走行を模擬する計算処理を実行し、仮想空間における表示画面（実際の自動車ではフロントガラスに相当する）の中心位置について、模擬されている仮想空間における三次元的な位置を算出する。

【0021】視点位置算出部8は、頭部センサ1から出力される頭部位置データ100と予め定められた磁気源6とCRTディスプレイ4との三次元的な位置関係に基づいて、使用者11の頭部におけるCRTディスプレイ4に対する三次元的な位置を算出するものである。

【0022】視点位置算出部8は、さらに、使用者11の頭部におけるCRTディスプレイ4に対する三次元的な位置、予め設定されている使用者11の頭部と視点との三次元的な位置関係、およびシミュレーション部7から出力される仮想位置データ102のそれぞれに基づいて、仮想空間における使用者11の視点の三次元的な位置を算出し、この処理結果である視点位置データ103を、模擬視界画像生成部3、視野算出部9、および視点姿勢算出部10のそれぞれに出力するものである。

【0023】ここで、視点位置算出部8は、上述した仮想空間における使用者11の三次元的な位置の算出において、例えば使用者11の両眼の中心位置を使用者11の視点とし、使用者11はCRTディスプレイ4に対してある方向に顔を向けていると仮定して幾何学的に視点位置を算出する。なお、使用者11の頭部と視点との三次元的な位置関係は、予めカメラ等で使用者11を撮影して個別に位置のデータを取り、このデータに基づいて設定するようにしてもよい。

【0024】視野算出部9は、シミュレーション部7から出力される仮想位置データ102と、視点位置算出部8から出力される視点位置データ103とに基づいて、仮想空間において使用者11の視点からCRTディスプレイ4の表示画面を見た場合に、仮想空間の画像がどの程度の視野で見えるかを算出し、例えば視野角や、仮想

空間の座標範囲で示して、視野データ104として出力するものである。

【0025】視点姿勢算出部10は、シミュレーション部7から出力される仮想位置データ102と、視点位置算出部8から出力される視点位置データ103とに基づいて、使用者11の視点の姿勢、すなわち使用者11の視線方向と左右の傾きとを算出し、例えばマトリクスや角度などで示して、視点姿勢データ105として出力するものである。

【0026】図2は、同実施形態における視点位置データ103、視野データ104、および視点姿勢データ105の例を示した図である。今、仮想空間において使用者11の視点12からCRTディスプレイ4の表示画面13を見ることを想定する。この場合、視点12の視点位置データ103が仮想空間の座標(x, y, z)によって示されている。また、視点12の位置から表示画面13を見たときの仮想空間の視野データ104が、視点12と表示画面13の中心14とを結んだ直線と、視点12と表示画面13の右上端15とを接続した直線との角度である視野角 θ によって示されている。さらに、視点12の視点姿勢データ105が、視点12に対する表示画面の中心14についてのベクトル α , β , γ として示されている。

【0027】模擬視界生成装置3は、シミュレーション部から出力される模擬計算結果データ101、視点位置算出部8から出力される視点位置データ103、視野算出部9から出力される視野データ104、および視点姿勢算出部10から出力される視点姿勢データ105のそれぞれに基づいて模擬視界画像106を生成してCRTディスプレイ4に出力するものである。

【0028】CRTディスプレイ4は、模擬視界生成装置3の生成した模擬視界画像106を使用者11に対して表示するものである。次に、本実施形態の動作について以下に説明する。

【0029】(本実施形態の動作) まず、使用者11が磁気センサ5の設けられたヘルメット等を被り、装置を起動したと想定する。磁気センサ5は磁気源6の磁気を検知し、使用者11の頭部の三次元的位置を算出して、頭部位置データ100として視点位置算出部8に出力する。

【0030】一方、磁気センサ1における頭部の位置検出処理とは独立して、シミュレーション部8は所定の模擬計算処理を実行し、この処理結果である模擬計算結果データ101を出力する。この模擬計算結果データ101は、模擬視界生成部3に入力される。

【0031】さらに、シミュレーション部8は、模擬計算の処理結果に基づいて、仮想空間におけるCRTディスプレイ4の表示画面の三次元的な位置を算出し、この算出結果である仮想位置データ102を出力する。この仮想位置データ102は、視点位置算出部8、視野算出

部9、および視点位置算出部10のそれぞれに入力される。

【0032】次に、視点位置算出部8は、頭部位置データ100および仮想位置データ102に基づいて、仮想空間における使用者11の視点の三次元的位置を算出し、この算出結果である視点位置データを103を出力する。この視点位置データ103は、模擬視界生成部3、視野算出部9、および視点姿勢算出部10のそれぞれに入力される。

【0033】次に、視野算出部9は、仮想位置データ101および視点位置データ103に基づいて、仮想空間における使用者の視点位置からCRTディスプレイ4の表示画面を見た場合の仮想空間の視野を算出し、この算出結果である視野データ104を出力する。この視野データ104は模擬視界生成部3に入力される。

【0034】一方、上述した視野算出部9とは別に、視点姿勢算出部10は、仮想位置データ101および視点位置データ103に基づいて、仮想空間における使用者11の視点の姿勢を算出し、この算出結果である視点姿勢データ105を出力する。この視点姿勢データ105は模擬視界生成部3に入力される。

【0035】次に、模擬視界生成部3は、視点位置データを103、視野データ104、および視点姿勢データ105のそれぞれに基づいて、模擬視界画像106を生成して出力する。この模擬視界画像106はCRTディスプレイ4に表示される。

【0036】上述した通り本実施形態においては、実空間における使用者11の視点の移動と連動して、仮想空間の使用者11の視点が変化し、その結果が考慮されて仮想空間における模擬視界画像106が生成される。そのため、実空間の使用者11の視点の動きに応じて仮想空間における模擬視界画像106が変化する。

【0037】図3は、同実施形態における視点の移動にともなう模擬視界画像106の変化の例を示す図である。ここで、視点16からCRTディスプレイ4の表示画面13を見ているときは、表示画面13には仮想空間の木18が画像20のように表示される。今、例えば実空間において使用者11が身を乗り出すなどして、使用者11の視点16が視点17に移ったと想定する。この場合、仮想空間において視点17からは木18の他に石19を見ることができるので、表示画面13には画像21が表示される。

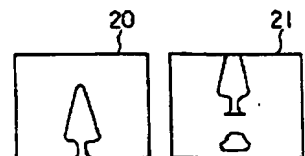
【0038】以上のように本実施形態は、実空間において使用者が頭を動かすなどして視点が移動しても、それに応じてその視点から見えるべき模擬視界画像が表示される。そのため、使用者にはCRTディスプレイを見ることがあたかも現実の窓を介して景色を観察するかのよう感じられて、より現実に近い感覚を得ることが可能となる。

【0039】本発明は上記実施形態に限定されるもので

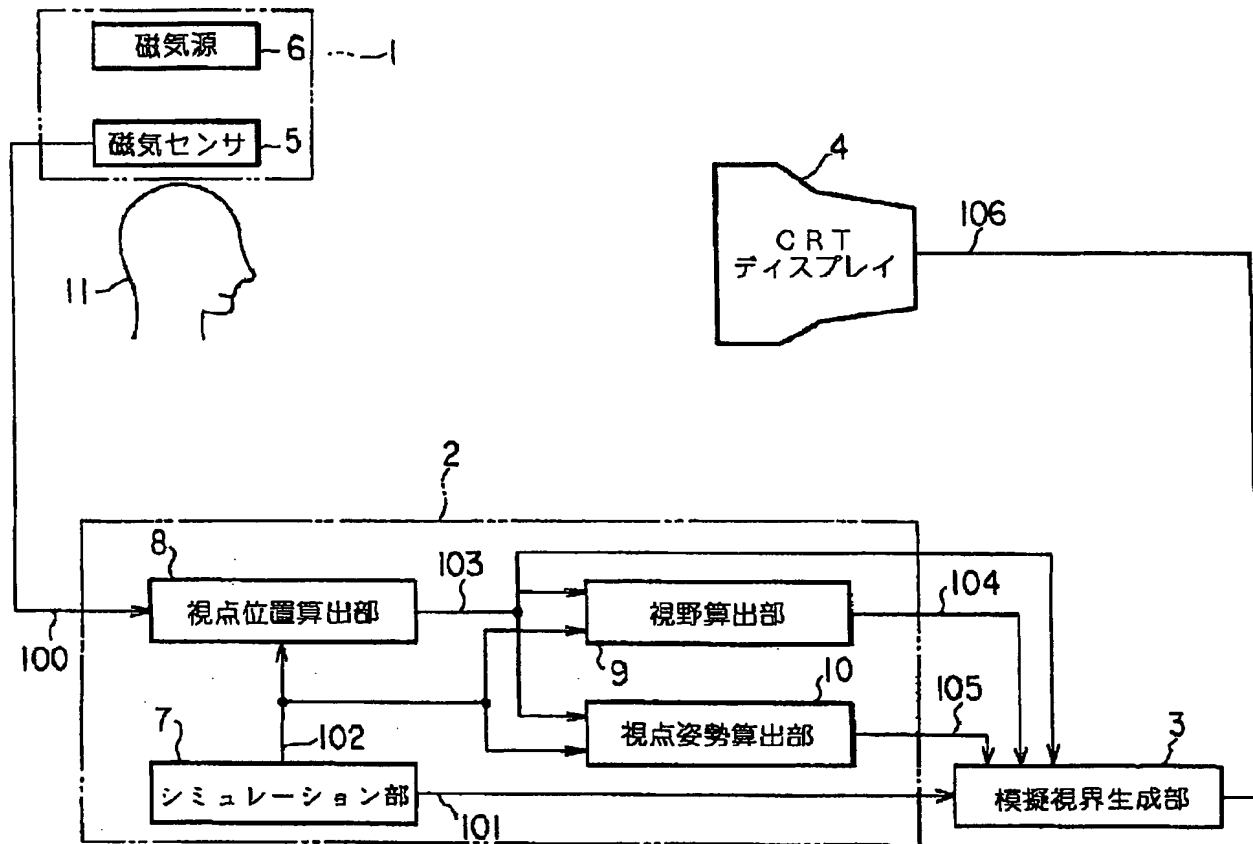
【図面の簡単な説明】

- 1…頭部センサ
- 2…視点表示情報算出部
- 3…模擬視界生成部
- 4…CRTディスプレイ
- 5…磁気センサ
- 6…磁気源
- 7…シミュレーション部
- 8…視点位置算出部
- 9…視野算出部
- 10…視点姿勢算出部
- 11…使用者
- 12…視点
- 13…表示画面
- 14…中心
- 15…右上端
- 16, 17…視点
- 18…木
- 19…石
- 20, 21…画像
- 100…頭部位置データ
- 101…模擬計算結果データ
- 102…仮想位置データ
- 103…視点位置データ
- 104…視野データ
- 105…視点姿勢データ
- 106…模擬視界画像
- x, y, z…視点位置の座標
- θ …視野角
- α, β, γ …視点姿勢のベクトル

【图3】



【図1】



フロントページの続き

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Claim 1] Simulation field-of-view equipment which is characterized by providing the following and which generates the simulation field-of-view picture according to operation of a user in the virtual space set up beforehand. A head position detection means to detect the position and posture of a head of a user in a real space. A field-of-view display information calculation means to compute each information about the position of a user's view in a virtual space, a visual field, and a posture based on the position and posture of a head of a user in the real space detected by the aforementioned head position detection means. A simulation field-of-view generation means to generate the simulation field-of-view picture which uses each information about the position of the view in the virtual space computed by the aforementioned field-of-view display information calculation means, a visual field, and a posture, and is observed from a user's view in a virtual space. A simulation field-of-view display means to display the simulation field-of-view picture generated by the aforementioned simulation field-of-view picture generation means.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the simulation field-of-view equipment applied to various kinds of simulators or the ** implement for amusement.

[0002]

[Description of the Prior Art] The simulation field-of-view equipment applied to the operation simulator and video game equipment of recent years, for example, an automobile, and the aircraft is developed. Such simulation field-of-view equipment is asked for the function in which feeling equivalent to an actual experience can be obtained according to operation of a user. Changing and expressing the result of the simulation computation which creates the target virtual space and changes according to operation of a user to a simulation field-of-view picture by the computer as one of the methods for this is performed.

[0003] With such simulation field-of-view equipment, a simulation field-of-view picture is generated as follows, for example. That is, based on a user's view in a real space, and the three-dimensions-physical relationship of the display screen, the three-dimensions-position of a user's view in a virtual space and the display screen is set up beforehand. Each information about the posture of the view at the time of seeing the display screen from a view in the size of the visual field at the time of seeing the display screen from a view in the position of the view at the time of seeing the display screen from a user's view in a virtual space and a virtual space based on this set-up position and a virtual space is computed. Based on each information about the position of these views, the size of a visual field, and the posture of a view, the simulation field-of-view picture observed from a user's view in a virtual space is generated.

[0004] Consequently, if conventional simulation field-of-view equipment is applied to the simulator of an automobilism, the view and the display screen in a virtual space will advance with simulation-advance of the automobile of a virtual space. Therefore, the simulation field-of-view picture copied out on the display screen is updated, and it will

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sense as if a user actually rides in an automobile and it was going on.

[0005] By the way, in conventional simulation field-of-view equipment, the value of each information about the position of a user's view in a virtual space, the size of a visual field, and the posture of a view is set up as constant value, respectively. That is, in conventional simulation field-of-view equipment, the three-dimensions-physical relationship of the view of a virtual space and the display screen was always fixed.

[0006] By the way, generally, in order for a user to move the head or to shake a neck, the three-dimensions-physical relationship of a user's view and display may be changed in a real space. Here, it assumes it to be equivalent to people looking at a scene from an aperture in a real space to see the display screen from a user's view in a virtual space. If the position of a view is changed while people are looking at the scene from the aperture, the scene which is in sight from an aperture will change according to it, and it will be large changeless like the scene of a position near from an aperture. That is, if the position of a view changes in a virtual space, the simulation field-of-view picture of the display screen will change according to it, and the change will be considered that the place near the display screen becomes large in a virtual space.

[0007] However, even if the three-dimensions-physical relationship of the view of a virtual space and the display screen is always fixed in conventional simulation field-of-view equipment as mentioned above, and the position of the view of a real space changed, feeling which the simulation field-of-view picture of the display screen does not change, and is different from an actual experience to a user was given.

[0008]

[Problem(s) to be Solved by the Invention] Even if a user's view moved in the real space since the three-dimensions-physical relationship of the user's view and the display screen in a virtual space was always fixed in conventional simulation field-of-view equipment as mentioned above, the simulation field-of-view picture of a virtual space had the trouble of not changing. this invention aims at offering the simulation field-of-view equipment from which movement of the view of the user of a real space is interlocked with, and the simulation field-of-view picture in a virtual space changes.

[0009]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, this invention is interlocked with change of the view of a real space, changes the view of a virtual space, and makes it the main point to generate a simulation field-of-view picture. Namely, this invention is set to the simulation field-of-view equipment which generates the simulation field-of-view picture according to operation of a user in the virtual space set up beforehand. A head position detection means to detect the position and posture of a head of a user in a real space, A field-of-view display information calculation means to compute each information about the position of a user's view in a virtual space, a visual field, and a posture based on the position and posture of a head of a user in the real space detected by the head position detection means, Each information about the position of the view in the virtual space computed by the field-of-view display information calculation means, a visual field, and a posture is used. It has a simulation field-of-view generation means to generate the simulation field-of-view picture observed from a user's view in a virtual space, and a simulation field-of-view display means to display the simulation field-of-view picture generated by the simulation field-of-view picture generation means.

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[0010] In the simulation field-of-view equipment of such composition, each information about the position of the view in a virtual space, a visual field, and a posture is computed based on the position and posture of a head in a real space. And each computed information is used and the simulation field-of-view picture observed from a user's view in a virtual space is generated.

[0011] Therefore, even when a user moves the head in a real space and a view moves, the view of a virtual space changes according to change of the view of the real space. And a simulation field-of-view picture is generated based on the three-dimensions-physical relationship of the view of a virtual space and the display screen which changed. That is, since a simulation field-of-view picture also changes with movement of the view of the user of a real space, a user becomes possible [obtaining the feeling more near reality].

[0012] Here, the position of the view in a virtual space is the three-dimensions-coordinate of the view in a virtual space. Moreover, the visual field of the view in a virtual space is the size of the virtual space observed when the position of a simulation field-of-view display means is assumed to a virtual space and a simulation field-of-view display means is seen from a view. Furthermore, the posture of the view in a virtual space is the posture at the time of seeing a simulation field-of-view display means from the view of a virtual space, i.e., a user's direction of a visual axis and an inclination on either side.

[0013]

[Embodiments of the Invention]

(Composition of equipment) Drawing 1 is the block diagram showing the composition of the simulation field-of-view equipment concerning the operation form of this invention. This simulation field-of-view equipment is divided roughly, and has the head sensor 1, the view display information calculation section 2, the simulation field-of-view generation section 3, and CRT display 4.

[0014] The head sensor 1 has a magnetometric sensor 5 and the source 6 of the MAG,
detects the MAG generated from the source 6 of the MAG by the magnetometric sensor
5, and outputs the head position data 100 which are the three-dimensions-position of a
user's 11 head.

[0015] The magnetometric sensor 5 consists of a hall device, a magnetic resistance element, etc., is the range which can detect enough the MAG generated from the source 6 of the MAG, and is installed in the place to which a three-dimensions-relative position can be changed to the source 6 of the MAG. Specifically, a magnetometric sensor 5 is installed in the helmet with which a user 11 is covered.

[0016] The source 6 of the MAG is constituted so that uniformly [the three-dimensions-relative position to CRT display 4]. Specifically, the source 6 of the MAG is installed in the seat where a user 11 sits down, and this seat and CRT display 4 join together, and it is constituted.

[0017] The field-of-view display information calculation section 2 of this operation gestalt has the simulation section 7, the view position calculation section 8, the visual field calculation section 9, and the view posture calculation section 10, and is constituted from usual by the general-purpose computer.

[0018] The target virtual space is set up beforehand, and the simulation section 7 performs simulation computation according to operation of a user in this virtual space, and computes the position of the display screen in a virtual space based on the processing result of simulation calculation further.

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[0019] Specifically, the simulation section 7 performs predetermined simulation computation according to operation of a user in a virtual space, and outputs the simulation calculation result data 101 which it is as a result of [this] processing to the simulation field-of-view generation section 3. Next, based on the result of simulation calculation, the simulation section 7 computes the three-dimensions-position of the image display section of CRT display 4 in a virtual space, and outputs the virtual position data 102 which it is as a result of [this] processing to each of the view position calculation section 7, the visual field calculation section 7, and the view posture calculation section 10.

[0020] Here, when applying for example, this operation form to an automobilism simulator, the simulation section 7 performs computation which simulates a run of an automobile, and computes the three-dimensions-position in the virtual space currently simulated about the center position of the display screen (by actual automobile, it is equivalent to a windshield) in a virtual space.

[0021] The view position calculation section 8 computes the three-dimensions-position to CRT display 4 in a user's 11 head based on the three-dimensions-physical relationship of the source 6 of the MAG and CRT display 4 which were beforehand determined as the head position data 100 outputted from the head sensor 1.

[0022] The three-dimensions-position to CRT display [in / a user's 11 head / further / in the view position calculation section 8] 4, The three-dimensions-physical relationship of the user's 11 head and view which are set up beforehand, And it is based on each of the virtual position data 102 outputted from the simulation section 7. The three-dimensions-position of a user's 11 view in a virtual space is computed, and the view position data 103 which it is as a result of [this] processing are outputted to each of the simulation field-of-view picture generation section 3, the visual field calculation section 9, and the view posture calculation section 10.

[0023] Here, the view position calculation section 8 makes the center position of a user's 11 both eyes a user's 11 view in calculation of a user's 11 three-dimensions-position in the virtual space mentioned above, and a user 11 assumes that the face is turned in the direction in which CRT display 4 is received, and computes a view position geometrically. In addition, the three-dimensions-physical relationship of a user's 11 head and a view photos a user 11 with a camera etc. beforehand, and takes the data of a position individually, and you may make it set them up based on this data.

[0024] When the display screen of CRT display 4 is seen from a user's 11 view in a virtual space based on the virtual position data 102 outputted from the simulation section 7, and the view position data 103 outputted from the view position calculation section 8, the visual field calculation section 9 computes with what visual field the picture of a virtual space is in sight, for example, shows it in an angle of visibility and the coordinate range of a virtual space, and outputs it as visual field data 104.

[0025] Based on the virtual position data 102 outputted from the simulation section 7, and the view position data 103 outputted from the view position calculation section 8, the view posture calculation section 10 computes the posture of a user's 11 view, i.e., a user's 11 direction of a visual axis and an inclination on either side, for example, shows it at a matrix, an angle, etc., and is outputted as view posture data 105.

[0026] Drawing 2 is drawing having shown the example of the view position data 103 in this operation gestalt, the visual field data 104, and the view posture data 105. It assumes

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seeing the display screen 13 of CRT display 4 from a user's 11 view 12 in a virtual space now. In this case, the view position data 103 of a view 12 are shown by the coordinate (x, y, z) of a virtual space. Moreover, the visual field data 104 of the virtual space when seeing the display screen 13 from the position of a view 12 are shown by the angle of visibility theta which is an angle with the straight line which connected the straight line which connected the view 12 and the center 14 of the display screen 13, and a view 12 and the upper right edge 15 of the display screen 13. Furthermore, the view posture data 105 of a view 12 are shown as vectors alpha, beta, and gamma about the center 14 of the display screen to a view 12.

[0027] Simulation field-of-view generation equipment 3 generates the simulation field-of-view picture 106 based on each of the simulation calculation result data 101 outputted from the simulation section, the view position data 103 outputted from the view position calculation section 8, the visual field data 104 outputted from the visual field calculation section 9, and the view posture data 105 outputted from the view posture calculation section 10, and outputs it to CRT display 4.

[0028] CRT display 4 displays the simulation field-of-view picture 106 which simulation field-of-view generation equipment 3 generated to a user 11. Next, operation of this operation gestalt is explained below.

[0029] (Operation of this operation gestalt) First, a user 11 is covered with the helmet with which the magnetometric sensor 5 was formed, and assumes that equipment was started. A magnetometric sensor 5 detects the MAG of the source 6 of the MAG, computes the three-dimensions-position of a user's 11 *****, and outputs it to the view position calculation section 8 as head position data 100.

[0030] On the other hand, the simulation section 8 performs predetermined simulation computation, and position detection processing of the head in a magnetometric sensor 1 outputs independently the simulation calculation result data 101 which it is as a result of [this] processing. This simulation calculation result data 101 is inputted into the simulation field-of-view generation section 3.

[0031] Furthermore, based on the processing result of simulation calculation, the simulation section 8 computes the three-dimensions-position of the display screen of CRT display 4 in a virtual space, and outputs the virtual position data 102 which it is as a result of [this] calculation. This virtual position data 102 is inputted into each of the view position calculation section 8, the visual field calculation section 9, and the view position calculation section 10.

[0032] Next, based on the head position data 100 and the virtual position data 102, the view position calculation section 8 computes the three-dimensions-position of a user's 11 view in a virtual space, and outputs 103 for the view position data which it is as a result of [this] calculation. This view position data 103 is inputted into each of the simulation field-of-view generation section 3, the visual field calculation section 9, and the view posture calculation section 10.

[0033] Next, the visual field calculation section 9 computes the visual field of the virtual space at the time of seeing the display screen of CRT display 4 from a user's view position in a virtual space based on the virtual position data 101 and the view position data 103, and outputs the visual field data 104 which it is as a result of [this] calculation. This visual field data 104 is inputted into the simulation field-of-view generation section 3.

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[0034] On the other hand, independently [the visual field calculation section 9 mentioned above], based on the virtual position data 101 and the view position data 103, the view posture calculation section 10 computes the posture of a user's 11 view in a virtual space, and outputs the view posture data 105 which it is as a result of [this] calculation. This view posture data 105 is inputted into the simulation field-of-view generation section 3.

[0035] Next, based on each of 103, the visual field data 104, and the view posture data 105, the simulation field-of-view generation section 3 generates the simulation field-of-view picture 106, and outputs view position data. This simulation field-of-view picture 106 is displayed on CRT display 4.

[0036] In this operation gestalt, movement of a user's 11 view in a real space is interlocked with, the view of the user 11 of a virtual space changes, the result is taken into consideration, and the simulation field-of-view picture 106 in a virtual space is generated as mentioned above. Therefore, according to the movement of the view of the user 11 of a real space, the simulation field-of-view picture 106 in a virtual space changes.

[0037] Drawing 3 is drawing showing the example of change of the simulation field-of-view picture 106 accompanying movement of the view in this operation gestalt. Here, while seeing the display screen 13 of CRT display 4 from the view 16, the tree 18 of a virtual space is displayed on the display screen 13 like a picture 20. A user 11 leans out in now, for example, a real space, and it is assumed that a user's 11 view moved from the view 16 to the view 17. In this case, since the stone 19 other than a tree 18 can be seen from a view 17 in a virtual space, a picture 21 is displayed on the display screen 13.

[0038] As mentioned above, even if a user moves the head in a real space and a view moves this operation form, the simulation field-of-view picture which should be in sight from the view according to it is displayed. Therefore, it senses as if seeing a CRT display to a user observed the scene through the actual aperture, and it becomes possible to obtain the feeling more near reality.

[0039] this invention is not limited to the above-mentioned operation form, can deform variously as follows and can be carried out.

(1) With the above-mentioned operation form, although position detection processing of a head was performed by the head sensor 1 which has a magnetometric sensor 5 and the source 6 of the MAG, it may be performed by the image processing in the picture which photoed a gyroscope sensor, the ultrasonic sensor, the sensor of a laser method, the sensor of radar system, or the head with the camera etc. For example, since it can detect in [not only the position of a head but the inclination of a head] three dimensions when using a gyroscope sensor, calculation of a more exact view position is attained. Moreover, individually, it may combine and these may be carried out.

(2) With the above-mentioned operation form, although the view posture was computed based on the result of position detection of a head, you may carry out direct detection of the eyeball operation using the eye marker equipment which detects eyeball operation. If it does in this way, since the direction of a user's look can detect directly, it becomes unnecessary to calculate a view posture by assuming that the user is looking at the center of the display screen of a CRT display like the above-mentioned operation form, and a more exact view posture can be computed.

(3) With the above-mentioned operation form, although constituted by the general-purpose computer, each function of the look display information calculation section 2

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may be divided into two or more general-purpose computers, and, as for the look display information calculation section 2, the control unit of exclusive use etc. may replace a part of each function. Furthermore, you may also include a part or all of each function of field-of-view information calculation equipment 2 in the interior of simulation field-of-view generation equipment 3.

(4) Although the display of a simulation field-of-view picture was performed using CRT display 4 with the above-mentioned operation form, you may transpose to various kinds of display, such as a projector.

[0040]

[Effect of the Invention] According to this invention, the simulation field-of-view equipment from which movement of the view of a real space is interlocked with, and the simulation field-of-view picture in a virtual space changes can be offered as mentioned above. Therefore, when this invention is applied to a simulator etc., a user can get feeling similar to an actual experience.

TECHNICAL FIELD

[The technical field to which invention belongs] this invention relates to the simulation field-of-view equipment applied to various kinds of simulators or the ** implement for amusement.

PRIOR ART

[Description of the Prior Art] The simulation field-of-view equipment applied to the operation simulator and video game equipment of recent years, for example, an automobile, and the aircraft is developed. Such simulation field-of-view equipment is asked for the function in which feeling equivalent to an actual experience can be obtained according to operation of a user. Changing and expressing the result of the simulation computation which creates the target virtual space and changes according to operation of a user to a simulation field-of-view picture by the computer as one of the methods for this is performed.

[0003] With such simulation field-of-view equipment, a simulation field-of-view picture is generated as follows, for example. That is, based on a user's view in a real space, and the three-dimensions-physical relationship of the display screen, the three-dimensions-position of a user's view in a virtual space and the display screen is set up beforehand. Each information about the posture of the view at the time of seeing the display screen from a view in the size of the visual field at the time of seeing the display screen from a view in the position of the view at the time of seeing the display screen from a user's view in a virtual space and a virtual space based on this set-up position and a virtual space is computed. Based on each information about the position of these views, the size of a visual field, and the posture of a view, the simulation field-of-view picture observed from a user's view in a virtual space is generated.

[0004] Consequently, if conventional simulation field-of-view equipment is applied to the simulator of an automobilism, the view and the display screen in a virtual space will advance with simulation-advance of the automobile of a virtual space. Therefore, the simulation field-of-view picture copied out on the display screen is updated, and it will

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sense as if a user actually rides in an automobile and it was going on.

[0005] By the way, in conventional simulation field-of-view equipment, the value of each information about the position of a user's view in a virtual space, the size of a visual field, and the posture of a view is set up as constant value, respectively. That is, in conventional simulation field-of-view equipment, the three-dimensions-physical relationship of the view of a virtual space and the display screen was always fixed.

[0006] By the way, generally, in order for a user to move the head or to shake a neck, the three-dimensions-physical relationship of a user's view and display may be changed in a real space. Here, it assumes it to be equivalent to people looking at a scene from an aperture in a real space to see the display screen from a user's view in a virtual space. If the position of a view is changed while people are looking at the scene from the aperture, the scene which is in sight from an aperture will change according to it, and it will be large changeless like the scene of a position near from an aperture. That is, if the position of a view changes in a virtual space, the simulation field-of-view picture of the display screen will change according to it, and the change will be considered that the place near the display screen becomes large in a virtual space.

[0007] However, even if the three-dimensions-physical relationship of the view of a virtual space and the display screen is always fixed in conventional simulation field-of-view equipment as mentioned above, and the position of the view of a real space changed, feeling which the simulation field-of-view picture of the display screen does not change, and is different from an actual experience to a user was given.

EFFECT OF THE INVENTION

[Effect of the Invention] According to this invention, the simulation field-of-view equipment from which movement of the view of a real space is interlocked with, and the simulation field-of-view picture in a virtual space changes can be offered as mentioned above. Therefore, when this invention is applied to a simulator etc., a user can get feeling similar to an actual experience.

So ... goes for actual as well

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Even if a user's view moved in the real space since the three-dimensions-physical relationship of the user's view and the display screen in a virtual space was always fixed in conventional simulation field-of-view equipment as mentioned above, the simulation field-of-view picture of a virtual space had the trouble of not changing. this invention aims at offering the simulation field-of-view equipment from which movement of the view of the user of a real space is interlocked with, and the simulation field-of-view picture in a virtual space changes.

MEANS

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, this invention is interlocked with change of the view of a real space, changes the view of a virtual space, and makes it the main point to generate a simulation field-of-view picture. Namely, this invention is set to the simulation field-of-view equipment

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which generates the simulation field-of-view picture according to operation of a user in the virtual space set up beforehand. A head position detection means to detect the position and posture of a head of a user in a real space, A field-of-view display information calculation means to compute each information about the position of a user's view in a virtual space, a visual field, and a posture based on the position and posture of a head of a user in the real space detected by the head position detection means, Each information about the position of the view in the virtual space computed by the field-of-view display information calculation means, a visual field, and a posture is used. It has a simulation field-of-view generation means to generate the simulation field-of-view picture observed from a user's view in a virtual space, and a simulation field-of-view display means to display the simulation field-of-view picture generated by the simulation field-of-view picture generation means.

[0010] In the simulation field-of-view equipment of such composition, each information about the position of the view in a virtual space, a visual field, and a posture is computed based on the position and posture of a head in a real space. And each computed information is used and the simulation field-of-view picture observed from a user's view in a virtual space is generated.

[0011] Therefore, even when a user moves the head in a real space and a view moves, the view of a virtual space changes according to change of the view of the real space. And a simulation field-of-view picture is generated based on the three-dimensions-physical relationship of the view of a virtual space and the display screen which changed. That is, since a simulation field-of-view picture also changes with movement of the view of the user of a real space, a user becomes possible [obtaining the feeling more near reality].

[0012] Here, the position of the view in a virtual space is the three-dimensions-coordinate of the view in a virtual space. Moreover, the visual field of the view in a virtual space is the size of the virtual space observed when the position of a simulation field-of-view display means is assumed to a virtual space and a simulation field-of-view display means is seen from a view. Furthermore, the posture of the view in a virtual space is the posture at the time of seeing a simulation field-of-view display means from the view of a virtual space, i.e., a user's direction of a visual axis and an inclination on either side.

[0013]

[Embodiments of the Invention]

(Composition of equipment) Drawing 1 is the block diagram showing the composition of the simulation field-of-view equipment concerning the operation gestalt of this invention. This simulation field-of-view equipment is divided roughly, and has the head sensor 1, the view display information calculation section 2, the simulation field-of-view generation section 3, and CRT display 4.

[0014] The head sensor 1 has a magnetometric sensor 5 and the source 6 of the MAG, detects the MAG generated from the source 6 of the MAG by the magnetometric sensor 5, and outputs the head position data 100 which are the three-dimensions-position of a user's 11 head.

[0015] The magnetometric sensor 5 consists of a hall device, a magnetic resistance element, etc., is the range which can detect enough the MAG generated from the source 6 of the MAG, and is installed in the place to which a three-dimensions-relative position can be changed to the source 6 of the MAG. Specifically, a magnetometric sensor 5 is installed in the helmet with which a user 11 is covered.

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[0016] The source 6 of the MAG is constituted so that uniformly [the three-dimensions-relative position to CRT display 4]. Specifically, the source 6 of the MAG is installed in the seat where a user 11 sits down, and this seat and CRT display 4 join together, and it is constituted.

[0017] The field-of-view display information calculation section 2 of this operation gestalt has the simulation section 7, the view position calculation section 8, the visual field calculation section 9, and the view posture calculation section 10, and is constituted from usual by the general-purpose computer.

[0018] The target virtual space is set up beforehand, and the simulation section 7 performs simulation computation according to operation of a user in this virtual space, and computes the position of the display screen in a virtual space based on the processing result of simulation calculation further.

[0019] Specifically, the simulation section 7 performs predetermined simulation computation according to operation of a user in a virtual space, and outputs the simulation calculation result data 101 which it is as a result of [this] processing to the simulation field-of-view generation section 3. Next, based on the result of simulation calculation, the simulation section 7 computes the three-dimensions-position of the image display section of CRT display 4 in a virtual space, and outputs the virtual position data 102 which it is as a result of [this] processing to each of the view position calculation section 7, the visual field calculation section 7, and the view posture calculation section 10.

[0020] Here, when applying for example, this operation gestalt to an automobilism simulator, the simulation section 7 performs computation which simulates a run of an automobile, and computes the three-dimensions-position in the virtual space currently simulated about the center position of the display screen (by actual automobile, it is equivalent to a windshield) in a virtual space.

[0021] The view position calculation section 8 computes the three-dimensions-position to CRT display 4 in a user's 11 head based on the three-dimensions-physical relationship of the source 6 of the MAG and CRT display 4 which were beforehand determined as the head position data 100 outputted from the head sensor 1.

[0022] The three-dimensions-position to CRT display [in / a user's 11 head / further / in the view position calculation section 8] 4, The three-dimensions-physical relationship of the user's 11 head and view which are set up beforehand, And it is based on each of the virtual position data 102 outputted from the simulation section 7. The three-dimensions-position of a user's 11 view in a virtual space is computed, and the view position data 103 which it is as a result of [this] processing are outputted to each of the simulation field-of-view picture generation section 3, the visual field calculation section 9, and the view posture calculation section 10.

[0023] Here, the view position calculation section 8 makes the center position of a user's 11 both eyes a user's 11 view in calculation of a user's 11 three-dimensions-position in the virtual space mentioned above, and a user 11 assumes that the face is turned in the direction in which CRT display 4 is received, and computes a view position geometrically. In addition, the three-dimensions-physical relationship of a user's 11 head and a view photos a user 11 with a camera etc. beforehand, and takes the data of a position individually, and you may make it set them up based on this data.

[0024] When the display screen of CRT display 4 is seen from a user's 11 view in a

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virtual space based on the virtual position data 102 outputted from the simulation section 7, and the view position data 103 outputted from the view position calculation section 8, the visual field calculation section 9 computes with what visual field the picture of a virtual space is in sight, for example, shows it in an angle of visibility and the coordinate range of a virtual space, and outputs it as visual field data 104.

[0025] Based on the virtual position data 102 outputted from the simulation section 7, and the view position data 103 outputted from the view position calculation section 8, the view posture calculation section 10 computes the posture of a user's 11 view, i.e., a user's 11 direction of a visual axis and an inclination on either side, for example, shows it at a matrix, an angle, etc., and is outputted as view posture data 105.

[0026] Drawing 2 is drawing having shown the example of the view position data 103 in this operation gestalt, the visual field data 104, and the view posture data 105. It assumes seeing the display screen 13 of CRT display 4 from a user's 11 view 12 in a virtual space now. In this case, the view position data 103 of a view 12 are shown by the coordinate (x, y, z) of a virtual space. Moreover, the visual field data 104 of the virtual space when seeing the display screen 13 from the position of a view 12 are shown by the angle of visibility θ which is an angle with the straight line which connected the straight line which connected the view 12 and the center 14 of the display screen 13, and a view 12 and the upper right edge 15 of the display screen 13. Furthermore, the view posture data 105 of a view 12 are shown as vectors α , β , and γ about the center 14 of the display screen to a view 12.

[0027] Simulation field-of-view generation equipment 3 generates the simulation field-of-view picture 106 based on each of the simulation calculation result data 101 outputted from the simulation section, the view position data 103 outputted from the view position calculation section 8, the visual field data 104 outputted from the visual field calculation section 9, and the view posture data 105 outputted from the view posture calculation section 10, and outputs it to CRT display 4.

[0028] CRT display 4 displays the simulation field-of-view picture 106 which simulation field-of-view generation equipment 3 generated to a user 11. Next, operation of this operation gestalt is explained below.

[0029] (Operation of this operation gestalt) First, a user 11 is covered with the helmet with which the magnetometric sensor 5 was formed, and assumes that equipment was started. A magnetometric sensor 5 detects the MAG of the source 6 of the MAG, computes the three-dimensions-position of a user's 11 *****, and outputs it to the view position calculation section 8 as head position data 100.

[0030] On the other hand, the simulation section 8 performs predetermined simulation computation, and position detection processing of the head in a magnetometric sensor 1 outputs independently the simulation calculation result data 101 which it is as a result of [this] processing. This simulation calculation result data 101 is inputted into the simulation field-of-view generation section 3.

[0031] Furthermore, based on the processing result of simulation calculation, the simulation section 8 computes the three-dimensions-position of the display screen of CRT display 4 in a virtual space, and outputs the virtual position data 102 which it is as a result of [this] calculation. This virtual position data 102 is inputted into each of the view position calculation section 8, the visual field calculation section 9, and the view position calculation section 10.

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[0032] Next, based on the head position data 100 and the virtual position data 102, the view position calculation section 8 computes the three-dimensions-position of a user's 11 view in a virtual space, and outputs 103 for the view position data which it is as a result of [this] calculation. This view position data 103 is inputted into each of the simulation field-of-view generation section 3, the visual field calculation section 9, and the view posture calculation section 10.

[0033] Next, the visual field calculation section 9 computes the visual field of the virtual space at the time of seeing the display screen of CRT display 4 from a user's view position in a virtual space based on the virtual position data 101 and the view position data 103, and outputs the visual field data 104 which it is as a result of [this] calculation. This visual field data 104 is inputted into the simulation field-of-view generation section 3.

[0034] On the other hand, independently [the visual field calculation section 9 mentioned above], based on the virtual position data 101 and the view position data 103, the view posture calculation section 10 computes the posture of a user's 11 view in a virtual space, and outputs the view posture data 105 which it is as a result of [this] calculation. This view posture data 105 is inputted into the simulation field-of-view generation section 3.

[0035] Next, based on each of 103, the visual field data 104, and the view posture data 105, the simulation field-of-view generation section 3 generates the simulation field-of-view picture 106, and outputs view position data. This simulation field-of-view picture 106 is displayed on CRT display 4.

[0036] In this operation gestalt, movement of a user's 11 view in a real space is interlocked with, the view of the user 11 of a virtual space changes, the result is taken into consideration, and the simulation field-of-view picture 106 in a virtual space is generated as mentioned above. Therefore, according to the movement of the view of the user 11 of a real space, the simulation field-of-view picture 106 in a virtual space changes.

[0037] Drawing 3 is drawing showing the example of change of the simulation field-of-view picture 106 accompanying movement of the view in this operation gestalt. Here, while seeing the display screen 13 of CRT display 4 from the view 16, the tree 18 of a virtual space is displayed on the display screen 13 like a picture 20. A user 11 leans out in now, for example, a real space, and it is assumed that a user's 11 view moved from the view 16 to the view 17. In this case, since the stone 19 other than a tree 18 can be seen from a view 17 in a virtual space, a picture 21 is displayed on the display screen 13.

[0038] As mentioned above, even if a user moves the head in a real space and a view moves this operation gestalt, the simulation field-of-view picture which should be in sight from the view according to it is displayed. Therefore, it senses as if seeing a CRT display to a user observed the scene through the actual aperture, and it becomes possible to obtain the feeling more near reality.

[0039] this invention is not limited to the above-mentioned operation gestalt, can deform variously as follows and can be carried out.

(1) With the above-mentioned operation gestalt, although position detection processing of a head was performed by the head sensor 1 which has a magnetometric sensor 5 and the source 6 of the MAG, it may be performed by the image processing in the picture which photoed a gyroscope sensor, the ultrasonic sensor, the sensor of a laser method, the sensor of radar system, or the head with the camera etc. For example, since it can detect

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in [not only the position of a head but the inclination of a head] three dimensions when using a gyroscope sensor, calculation of a more exact view position is attained.

Moreover, individually, it may combine and these may be carried out.

(2) With the above-mentioned operation gestalt, although the view posture was computed based on the result of position detection of a head, you may carry out direct detection of the eyeball operation using the eye marker equipment which detects eyeball operation. If it does in this way, since the direction of a user's visual axis can detect directly, it becomes unnecessary to calculate a view posture by assuming that the user is looking at the center of the display screen of a CRT display like the above-mentioned operation gestalt, and a more exact view posture can be computed.

(3) With the above-mentioned operation gestalt, although constituted by the general-purpose computer, each function of the visual-axis display information calculation section 2 may be divided into two or more general-purpose computers, and, as for the visual-axis display information calculation section 2, the control unit of exclusive use etc. may replace a part of each function. Furthermore, you may also include a part or all of each function of field-of-view information calculation equipment 2 in the interior of simulation field-of-view generation equipment 3.

(4) Although the display of a simulation field-of-view picture was performed using CRT display 4 with the above-mentioned operation form, you may transpose to various kinds of display, such as a projector.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The block diagram showing the composition of the simulation field-of-view equipment concerning the operation gestalt of this invention

[Drawing 2] Drawing having shown the example of the view position data in this operation gestalt, visual field data, and view posture data

[Drawing 3] Drawing showing the example of change of the simulation field-of-view picture accompanying movement of the view in this operation gestalt

[Description of Notations]

1 -- Head sensor

2 -- View display information calculation section

3 -- Simulation field-of-view generation section

4 -- CRT display

5 -- Magnetometric sensor

6 -- Source of the MAG

7 -- Simulation section

8 -- View position calculation section

9 -- Visual field calculation section

10 -- View posture calculation section

11 -- User

12 -- View

13 -- Display screen

14 -- Center

15 -- Upper right edge

16 17 -- View

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18 -- Tree
19 -- Stone
20 21 -- Picture
100 -- Head position data
101 -- Simulation calculation result data
102 -- Virtual position data
103 -- View position data
104 -- Visual field data
105 -- View posture data
106 -- Simulation field-of-view picture
x y, z -- Coordinate of a view position
theta -- Angle of visibility
alpha, beta, gamma -- Vector of a view posture

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